PG&E EPIC 3 Application Overview

EPIC 3 INVESTMENT PLAN STAKEHOLDER WORKSHOP

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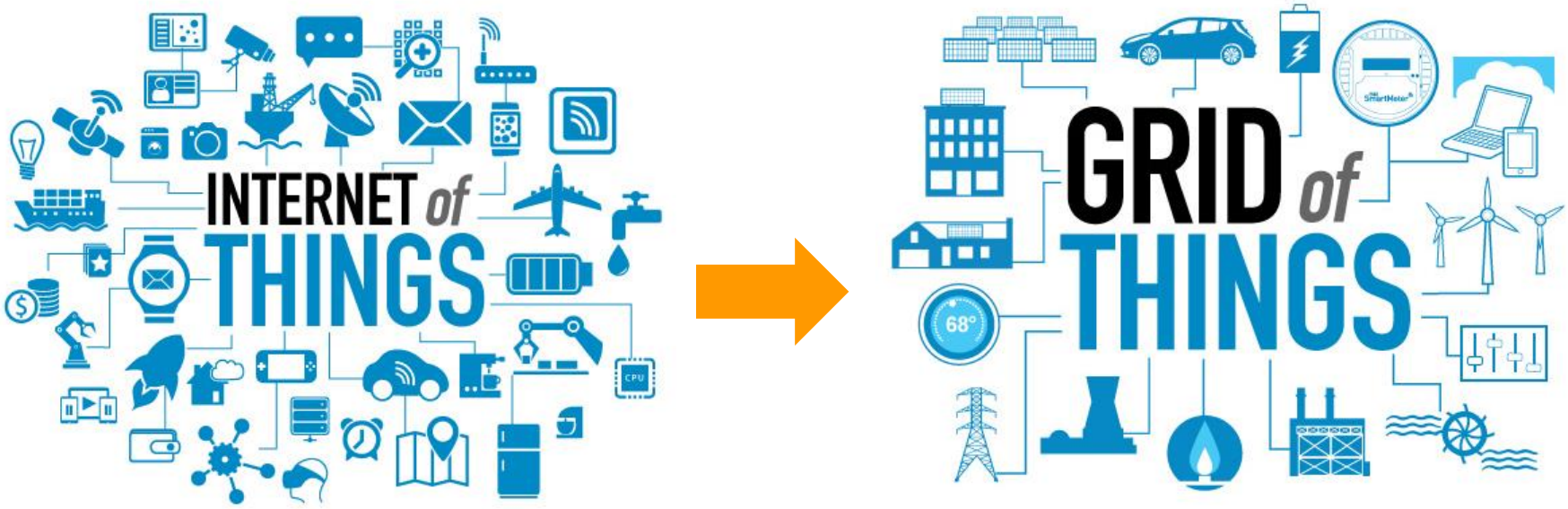
San Francisco, CA

September 8, 2017

PG&E's Vision - The Grid of Things

The Grid of Things™: The always there, always on platform that enables all the products and services customers need to engage with and use energy



PG&E's Vision for EPIC:

- PG&E continues to be strongly committed to the EPIC Program and the value it provides to our customers
- EPIC's main goals align closely with PG&E's "Grid of the Future" strategy
- EPIC offers the opportunity to cost-effectively develop and demonstrate innovative technologies which can advance PG&E's core values of safety, reliability, and affordability while advancing California's clean energy policies

EPIC Project Selection and Execution Approach

Four Lens Approach	Description
Policy/Regulatory Alignment	Alignment to EPIC mandatory guiding & secondary principles, as well as CPUC Proceedings, PUC 740.1 (Utility RD&D Goals) and 8360-8369 (Smart Grid Goals)
Alignment to Utility Strategies & Customer Needs	Ensures the issue(s) addressed by projects solve relevant concerns faced by PG&E's customers, while also having a clear path to production if the technology is proven ready to scale
Alignment with Innovation Characteristics	Must demonstrate a new or novel technology, demonstrate an existing technology in a novel way, and/or demonstrate a new or novel process or strategy
Alignment to Project Governance Considerations	Projects are overseen via matrix-style governance through PG&E's Program Management Office (PMO) that maintains overall accountability of the EPIC portfolio

EPIC Program Investment Areas

PG&E is focused on Technology, Demonstration and Deployment (TD&D) Projects that address emergent grid needs while continuing to provide safe, reliable and affordable services and also advance California energy policies in a cost-effective manner

The EPIC program has 4 key investment areas of focus:

Renewables & Distributed Energy Resource Integration

Grid Modernization & Optimization

Customer Service & Enablement

Cross-Cutting / Foundational Strategies & Technologies

Proposed EPIC 3 Projects Align with EPIC Principles

Enhance program targeting and combinations of DER technologies to enable easier **IDER / IDSM adoption**; Increase adoption of **EV and Storage**

Expand operational capabilities (DERMS / ADMS) to **optimize the grid** through the use of DERs

Test transactive technologies **and new DER Market Operations**

Enable more **dynamic and DER-oriented rates**, including valuation of DER grid services at a granular level to enable improved understanding of DER location based impacts / future potential tariffs

Improve **understanding of DER grid impacts**, location-specific protection settings

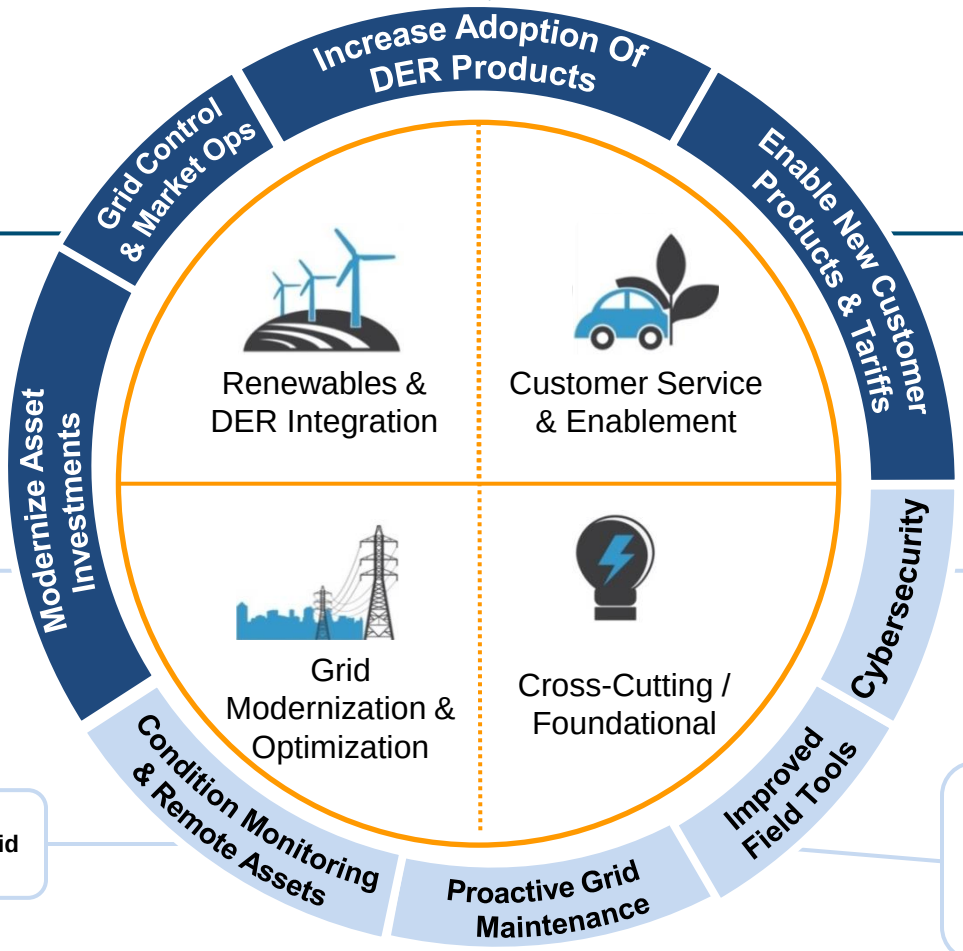
Improve **protections against bad actor access** in critical facilities (e.g. rogue wireless access points, cyber-physical coordinated security)

Leverage sensor technology to improve **active monitoring of Grid Assets**

Improve field **worker safety, efficiency** and access to real-time information

Develop foundational technologies to enable **Drone** utility use cases

Move maintenance / outage mitigation from **reactive to proactive** leveraging advanced data analytics approaches



PG&E EPIC Projects

To Date, PG&E has completed **16 EPIC Projects**

- Final reports can be found at www.pge.com/epicfinalreports

EPIC 3 proposes 43 projects, summaries can be found in the Appendix

- This includes two projects from Advice Letter 5015-E which were declined by the CPUC solely due to failure to meet the CPUC's "immediacy guidelines" for new projects that arise between EPIC triennial reviews
- PG&E included the Advice Letter in the Appendix of our EPIC 3 Application to ensure these projects would move forward, as long as there was no other reason to hold on the project outside of timing

Example of Projects Included:

Renewables and DER Integration

2.32 Electric Load Management for Ridesharing Electrification (EPIC 3 Project Number 3.42): Understand and demonstrate grid impacts from Electric Vehicle (EV) charging used for ridesharing fleet applications and assess the ability to manage the resulting electric load using active demand management.

3.03 DERMS / ADMS Advanced Functionality: Leverage DERMS to facilitate enhanced visibility/control over DERs & other grid assets; incorporate additional technologies into DERMS and increase DER coordination through aggregation for optimized dispatch, including DR & EV Integration, VVO functionality, direct resource aggregation, and load cycling. Project may also explore dispatch DERs for restoration switching use cases leveraging estimated time of restoration forecasts

Grid Modernization and Optimization

3.21 Advanced Vegetation Management: Model tree growth rate and historical vegetation related outages to recommended proactive, targeted mitigations using LiDAR and other remote sensing data for reliability planning, vegetation management and resource allocation

EPIC Program – Recommended Ways to Enhance Disadvantaged Community Support

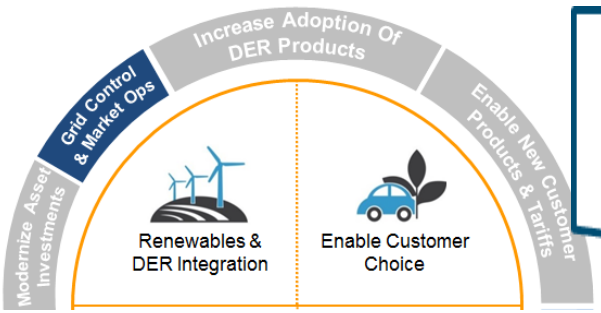
1. PG&E recommends supporting DACs through CEC's market facilitation activities and the IOUs other market facilitation approved programs (e.g., SGIP, EE, DR)
   - Note that a program rule and budget change would be needed for IOUs to participate in market facilitation through EPIC

2. PG&E will also add additional visibility and outreach for DACs into the EPIC work through an expanded focus on encouraging Diverse Suppliers that have technologies that match what the utilities are proposing to demonstrate:
   - Continue outreach to DACs to raise awareness of opportunities to either apply for EPIC funds or benefit from the results
   - Provide a workshop to diverse suppliers on the overview of the EPIC program portfolio and clarify how they can participate when RFPs open
   - Proactively invite DACs to the EPIC workshops held bi-annually by the EPIC program administrators

PG&E will enhance our DAC outreach and targeting in order to ensure our EPIC projects meet the needs of our customers, including providing direct benefits to customers, residents and businesses in DACs, while taking into consideration that:

- Technologies which are at the demonstration phase are often largely unproven, and therefore can present risks that may be inappropriate or premature for DAC outreach or targeting
- Our EPIC DAC targeting should emphasize the benefits of the project to DAC customers, residents, employees and businesses, even if the location of the project is outside a DAC.

Appendix



Grid Control & Market Operations

Expand operational capabilities (DERMS/ADMS) to **optimize the grid** through the use of DERs

Leverage transactive technologies and test **new DER market operations**

DERMS and/or ADMS Advanced Functionality

3.02 Utility Aggregated Resources w/ Market Participation: Develop and demonstrate multi-technology Distributed Energy Resource (DER) aggregation (e.g. Solar, Storage) for wholesale market operations with potential to explore multiple uses including distribution support, retail, and/or T&D interfaces for control center operations

3.03 DERMS / ADMS Advanced Functionality: Leverage DERMS to facilitate enhanced visibility/control over DERs & other grid assets; incorporate additional technologies into DERMS and increase DER coordination through aggregation for optimized dispatch, including DR & EV Integration, VVO functionality, direct resource aggregation, and load cycling. Project may also explore dispatch DERs for restoration switching use cases leveraging estimated time of restoration forecasts

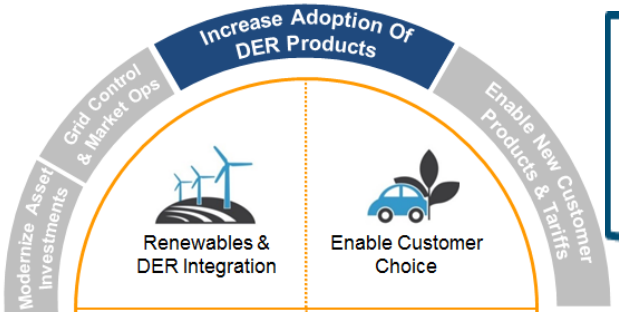
Transactive Energy Market

3.04 Multi-Nodal Distributed Digital Ledger: Demonstrate/evaluate a multi-nodal digital distributed ledger (e.g. Blockchain) as an enabling technology that may facilitate greater efficiency, transparency in customer transactions & customer security (including potential use cases, such as rate roaming, localized microgrid energy exchanges, asset data and credit tracking)

3.05 Virtual DER Markets for Capacity and Other Attributes: Demonstrate autonomous distributed economic dispatch in the context of DER markets for capacity and other attributes, exploring a locally-sited optimization algorithm that could respond to various market signals that either exist today or may exist in the future in coordination with neighboring DERs (optimize DER dispatch decisions to maximize value and reduce redundant costs)

Enhanced VVO

3.12 Advanced Volt/Var Optimization (VVO) Functionalities: Demonstrate enhanced algorithms to leverage Volt Var Optimization (VVO) for grid management services. Potential use cases include distribution capacitors to reduce transmission congestion and leveraging distributed smart inverters (further improve grid stability)



Increase Adoption of DER Products

Enhance program targeting and combinations of DER technologies to enable easier **IDER / IDSM adoption** (e.g. EV w/ Storage, BTM Resource Optimization, Energy Resilience)

Improve understanding of DER grid impacts, location-specific device settings

Increase adoption of **EV and Storage**

Energy Storage – Behind-the-Meter

3.06 Auto ID BTM Storage: Identify Behind the Meter storage devices with interval and/or voltage data to understand their behavior with respect to charging and discharging (grid safety and potential to leverage during peak hours)

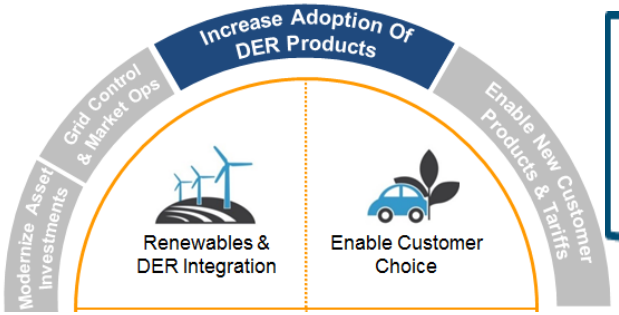
Energy Storage – Utility Scale

3.07 Utility Scale Storage For Load Balancing: Demonstrate phase load balancing by leveraging large, utility-owned batteries, which may use smart inverters to test the ability to use the load from the energy storage device to shift load between phases (operational efficiency vs. manually moving loads to rebalance them improves reliability by optimizing asset utilization across the phases)

3.08 Second Life Batteries For Grid Needs: Reuse battery systems from EV applications and/or other hybrid vehicle battery systems in the industry for utility grid support, with functions such as demand response and/or frequency regulation (lower cost energy storage, support EV business case with residual value)

Energy Resilience

3.11 Location-Specific Options for Reliability and/or Resilience Upgrades: Develop a processes and specification that can be tested to evaluate multiple-DER technology configurations that could potentially serve as location-specific options for distribution system reliability and/or resilience upgrades, such as distributed battery storage, distributed solar and other distributed generation, microgrid controllers, and isolation and protection equipment enabling islanding (reduced operating costs, improved local reliability, supports DER adoption)



Increase Adoption of DER Products (Cont.)

Enhance program targeting and combinations of DER technologies to enable easier **IDER / IDSM adoption** (e.g. EV w/ Storage, BTM Resource Optimization, Energy Resilience)

Improve understanding of DER grid impacts, location-specific device settings

Increase adoption of **EV and Storage**

DER Impact Analysis

3.01 Automated DER Impact and Long Term Dynamics Evaluation: Automate the DER impact and long term dynamics evaluation process (reducing DER study timeline/cost, improving understanding and management of voltage impacts caused by multiple DERs on a single circuit as well as its impact on LTC operations, potentially leading to improved hosting capacity within the distribution system)

3.09 Dynamic Near-Term DER Load Forecasting: Demonstrate an algorithm leveraging smart inverter data with other data streams (e.g., local weather, customer demographics, customer usage) that can better predict customer gross and net usage/load, Distributed Energy Resource (DER) generation, back-feed at distribution assets, and impact on system level or local short-term energy supply needs (reduce generation purchasing buffer, reduce distribution operating cost, further insight for distribution planning)

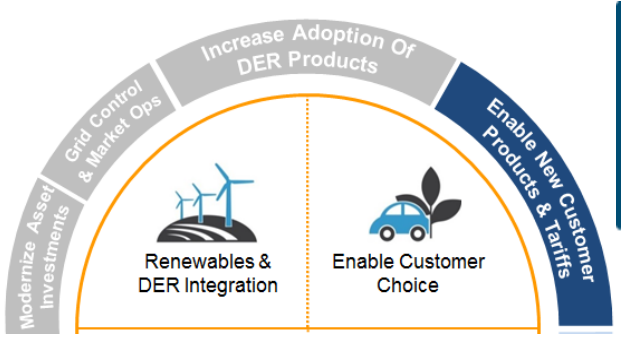
3.10 Grid of the Future Scenario Engine: Wide-scale distribution and/or transmission grid simulator for analyzing multiple scenarios and potential future stressors to the grid, such as changes in usage behavior, increased DER integration rates and more, to facilitate better informed grid planning

Electric Vehicles

3.28 Real Time Load Based Charging: Demonstrate a “smart” Electric Vehicle (EV) charging application by coordinating and staggering residential EV charging with the aim of avoiding potential distribution system issues caused by numerous EVs in a local area that are charging at the same time (support EV growth while maintaining grid reliability and avoiding costly upgrades)

***3.42 Electric Load Management for Ridesharing Electrification:** Evaluate the charging load profile and grid impacts of Electric Vehicle (EV) charging used for the new rideshare use case and assess ability to manage the resulting load using active demand management

*Project proposed via 5015-E Advice Letter



Enable New Customer Products and Tariffs

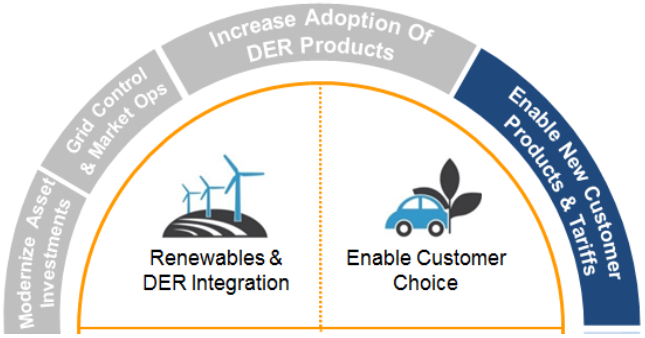
Enable more **dynamic and DER-oriented rates**, including valuation of DER grid services at a granular level to enable improved understanding of DER location based impacts / future potential tariffs

Metering Technology

3.25 Electric Grid Monitoring Meter (EGM): Demonstrate a modular-designed meter to reduce equipment costs for meter replacements, monitor the electric grid operations and report real time outage and restoration, and also function as a SCADA metering point during the critical and initial 10-30 minutes of a power outage (report power conditions via voltage values, enable additional insight into outages via additional last gasp data, affordability).

3.26 Predictive Data Analytics for Proactive Meter Replacement: Create and demonstrate an algorithm for remotely diagnosing meter health, helping to target and prioritize meter replacements (reduce truck rolls, better targeted issue resolution)

3.27 Multi-Purpose Meter (MPM): Demonstrate a meter that can measure energy consumption for multiple customers and/or multiple uses, in the place of multiple single-use and/or sub-meters (reduced operational and asset costs, enable future DER and smart city options)



Enable New Customer Products and Tariffs (cont.)

Enable more **dynamic and DER-oriented rates**, including valuation of DER grid services at a granular level to enable improved understanding of DER location based impacts / future potential tariffs

Customer Facing Tools

3.29 Advanced Customer Bill Scenario Calculator: Demonstrate an online tool with a streamlined graphical user interface to allow customers to more easily understand how behavioral changes and technology investments may affect their energy bill

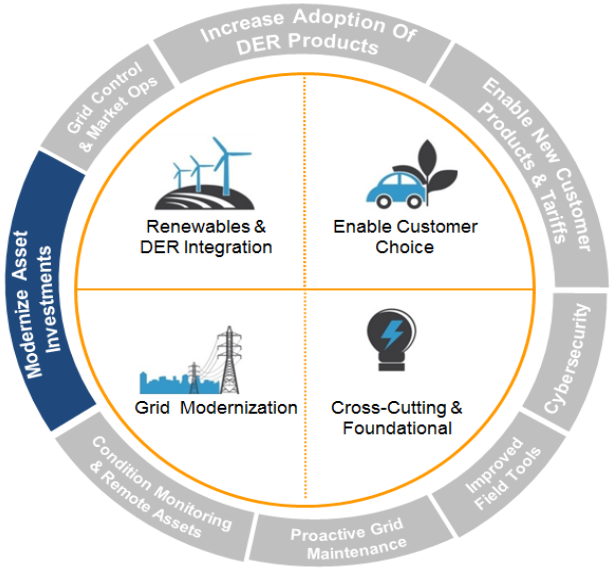
Advanced Pricing / Rates / Tariffs

3.30 Connected Device Real-Time Pricing-Based Control: Technology demonstration of real-time pricing service impacts upon sending signals to connected devices to control their operation based on pricing signals and/or grid conditions

3.31 Real-Time DER Price Signals: Design and demonstrate a locational net benefit rate design structure for DERs in order to valuate DER grid services to incentivize optimal DER siting and dispatch

Power Quality

3.32 System Harmonics for Power Quality Investigations: Leverage SmartMeter™ data to assist in identifying system harmonics that may cause power quality issues for customers (more proactive issue resolution, improve operational efficiency)



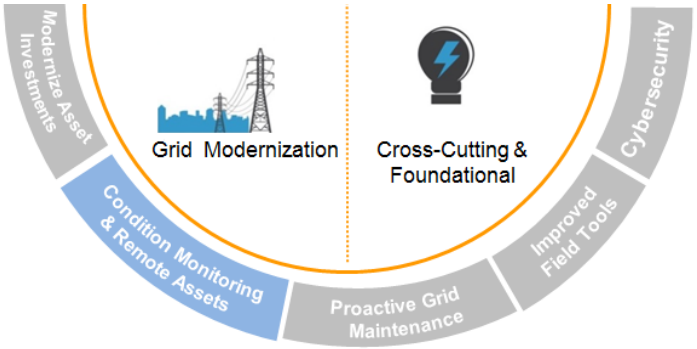
Modernize Asset Investments

Improve **Asset Settings, Management** and **Control**

Asset Settings and Control

3.17 Generic Universal Distribution Controller (UDC) for Relay, Regulator, LTC, Capacitor, Interrupter Control: Demonstrate a UDC that can act as a generic controller for use in electric distribution line equipment with enough generic input/output and software flexibility to be used as a capacitor controller, voltage regulator controller, an LTC controller, or a distribution relay (reduced hardware, vendor and operating costs through standardization)

3.23 Enhanced Distribution Line Equipment Device Settings Management: Demonstrate the increased efficiency, quality assurance, and flexibility of expanding existing technology at PG&E used currently to manage transmission and substation distribution protection relay device settings to all distribution line equipment relays and controllers



Condition Monitoring & Remote Asset Diagnostics

Leverage sensor technology to improve
active monitoring of Grid Assets

Advanced Condition Monitoring and Remote Diagnostics

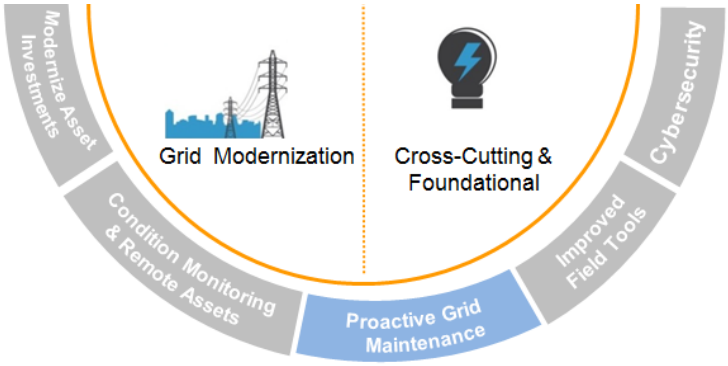
3.13 Transformer Monitoring via Field Area Network (FAN): Demonstrate equipment that can be quickly and safely mounted on the casing of a pole-top distribution transformer to enable monitoring of equipment health, and potentially test new communication devices to deliver sensor data through FAN (transformer preventative maintenance, improved understanding of "plug and play" equipment installation)

3.14 Maintenance Prioritization for Imminent Asset Risk: Demonstrate a situational intelligence model and an operational dashboard to identify and display assets' health and Condition-Based Monitoring (CBM) information for prioritization of short-term operational, maintenance, and replacement activities

3.16 Advanced Condition Monitoring for Remote Diagnostics: Demonstrate advanced real-time sensors for monitoring asset conditions, enabling an increasingly proactive maintenance and grid management operational model (improved sensor affordability, new data and analysis, enable larger scale deployments of CBM)

3.18 Transformer Health Monitoring: Develop and demonstrate new algorithms for determining and actively monitoring transformer health and performance based on synchrophasor and/or other data to detect conditions such as arcing, breaker mis-operation, proper reclosing, total fault energy over time (Transmission Asset Monitoring, enhanced predictive failure analytics)

3.19 Unified Network Solution: Demonstrate a platform for unified communication using the service and availability of one network to the benefit of the other networks (such as SCADA, land mobile radio, smart meter, Field Area Network)



Reactive to Proactive Grid Maintenance

Move maintenance / outage mitigation from **reactive to proactive** leveraging advanced data analytics approaches

Predictive Maintenance

3.15 Proactive Wires Down Mitigation: Identify a falling conductor in sub-second response time to enable proactive circuit isolation prior to the conductor making contact with the ground (wire down safety)

3.20 Data Analytics for Predictive Maintenance: Develop predictive maintenance algorithms for identifying potential asset failures before they occur by using SmartMeter™ voltage data and other utility data sources at service points downstream of equipment (reduce unplanned outages; use cases to be explored include primary side loose neutrals, overloaded or near-failure transformers, and stressed or near-failure cables)

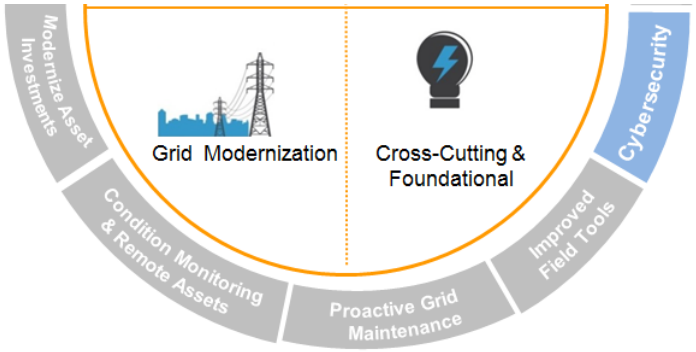
3.21 Advanced Vegetation Management: Model tree growth rate and historical vegetation related outages to recommended proactive, targeted mitigations using LiDAR and other remote sensing data for reliability planning, vegetation management and resource allocation

3.22 Abnormal State Configuration Risk and Mitigations: Create and demonstrate an algorithm for understanding the comparative risk of PG&E's abnormal state configurations to proactively prioritize mitigation of these issues (reduce outage risk)

3.24 Automatic Power Factor (PF) Management: Demonstrate an algorithm to achieve automatic power factor management to keep power factor within the mandated CAISO guideline (affordability over current approaches)

***3.43 Service Issue Identification Leveraging Momentary Outage Information:** Demonstrate approach to proactively identify potential service issue problems related to locations with frequent momentary outages, which may be caused by imminent failures of conductors, insulators, transformers and/or vegetation contact

***Project proposed via 5015-E Advice Letter**



Cybersecurity

Improve **protections against bad actor access** in critical facilities
(e.g. rogue wireless access points, cyber-physical coordinated security)

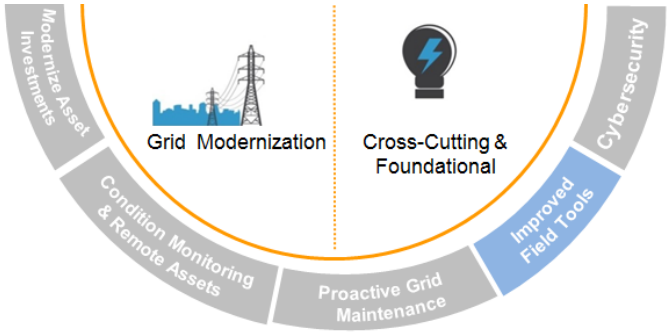
Cybersecurity

3.33 Cyber-Physical Integrated Security: Demonstrate a unified security solution which matches physical access to system access to aid in the blocking of unauthorized access to PG&E's critical infrastructure

3.34 Local Wireless Security For Critical Facilities: Develop and demonstrate a next-generation wireless security solution which would monitor airwaves around PG&E's electric facilities to detect rogue access points installed within physically secured generation / substation facilities, which could provide bad actors access to the critical infrastructure networks

3.35 Advance Security of Internet of Things (IoT) Communications: Demonstrate an open architecture standard for secure communications between a utility and customer devices using third party communications channels (e.g. home internet connections, cellular networks, and private-built field area networks)

3.36 Cybersecurity for Industrial Control Systems (ICS): Joint EPIC Administrator collaborative project: Builds on foundational CES-21 learnings, potential demonstrations include adaptive controls and dynamic zoning for industrial control systems and enhanced visual interfaces of the simulation engines s that include converged network and grid models



Improved Field Tools

Leverage augmented reality, "SIRI"-type functions, and other associated field workforce tools to
improve field access to real-time information

Develop foundational technologies to enable **Drone** utility use cases

Advanced Tools For Field Work

3.37 Augmented Reality: Demonstrate technology to visualize grid and asset data integrated with GIS, superimposed on a device to provide real-time support and guidance for asset investigations / maintenance

3.38 Voltage Checks: Tool to provide remote voltage checks for field workers to identify low or no power situations while on-site without the need to call the central office or manually measure the line

3.40 Advanced Field Reference Tool: Voice guided and/or free-form entry reference for field workers to ask questions and receive guidance based on PG&E's equipment libraries, safety practices, and other critical documentation

Advanced Outage Restoration

3.39 Optimized Dispatch For Restoration Events: Optimize outage dispatch to support restoration operations by optimizing crew movements and responses (Algorithm could be trained for weather, traffic, expected job length, current crew locations, etc. May also provide logistics support to the Emergency Operations Center to reduce the number of calculations/decisions being made)

Drone Enablement and Operational Use

3.41 Drone Enablement and Operational Use: Demonstrate a foundational utility-focused drone control management system and improved charging techniques, as well as drones for operational use cases such as advanced condition-based monitoring and transmission line power harvesting

PG&E's 2018-2020 EPIC Project Portfolio

Investment Area: Renewables and DER Integration

Project Information		Primary EPIC Guiding Principles			Complimentary EPIC Guiding Principles				
#	Name	Safety	Reliability	Affordability	Societal Benefits	GHG Emissions Mitigation/ Adaptation	Loading Order	Economic Dev.	Efficient Use of Ratepayer Monies
01	Automated DER Impact and Long Term Dynamics Evaluation		✓	✓					✓
02	Utility Aggregated Resources with Market Participation			✓					✓
03	DERMS and ADMS Advanced Functionality	✓	✓	✓		✓	✓	✓	✓
04	Multi-Nodal Distributed Digital Ledger		✓	✓	✓			✓	✓
05	Virtual DER Markets for Capacity and Other Attributes		✓	✓		✓			✓
06	Auto Identification (ID) of Behind-the-Meter (BTM) Storage		✓	✓	✓	✓	✓		✓
07	Utility Scale Storage for Load Balancing	✓	✓	✓			✓		✓
08	Second-Life Batteries for Grid Needs		✓	✓		✓	✓	✓	✓
09	Dynamic Near-Term DER Load Forecasting			✓	✓	✓	✓		✓
10	Grid of the Future Scenario Engine	✓	✓	✓		✓	✓		✓
11	Location-Specific Options for Reliability and/or Resilience Upgrades		✓	✓	✓		✓		✓
42	Electric Load Management for Ridesharing Electrification		✓	✓					

PG&E's 2018-2020 EPIC Project Portfolio

Investment Area: Grid Modernization and Optimization

Project Information		Primary EPIC Guiding Principles			Complimentary EPIC Guiding Principles				
#	Name	Safety	Reliability	Affordability	Societal Benefits	GHG Emissions Mitigation/ Adaptation	Loading Order	Economic Dev.	Efficient Use of Ratepayer Monies
12	Advanced Volt/Var Optimization (VVO) Functionalities		✓	✓					✓
13	Transformer Monitoring via Field Area Network (FAN)	✓	✓	✓					✓
14	Maintenance Prioritization for Imminent Asset Risk	✓	✓	✓					✓
15	Proactive Wire Down Mitigation	✓	✓						
16	Advanced Condition Monitoring for Remote Diagnostics		✓	✓	✓				✓
17	Generic Universal Distribution Controller (UDC) for Relay, Regulator, Load Tap Changer (LTC), Capacitor, Interrupter Control			✓					✓
18	Transformer Health Monitoring		✓	✓	✓				✓
19	Unified Network Solution		✓	✓	✓				
20	Data Analytics for Predictive Maintenance	✓	✓	✓					✓
21	Advanced Vegetation Management Insights Using Prescriptive Analytics	✓	✓	✓	✓				✓
22	Abnormal State Configuration Risk and Mitigations	✓	✓		✓				✓
23	Enhanced Distribution Line Equipment Device Settings Mgmt.		✓	✓					✓
24	Automatic Power Factor (PF) Management		✓	✓					✓
43	Service Issue Identification Leveraging Momentary Outage Information	✓	✓	✓					

PG&E's 2018-2020 EPIC Project Portfolio

Investment Area: Customer Service and Enablement

Project Information		Primary EPIC Guiding Principles			Complimentary EPIC Guiding Principles				
#	Name	Safety	Reliability	Affordability	Societal Benefits	GHG Emissions Mitigation/ Adaptation	Loading Order	Economic Dev.	Efficient Use of Ratepayer Monies
25	Electric Grid Monitoring (EGM) Meter		✓	✓					✓
26	Predictive Data Analytics for Proactive Meter Replacement		✓	✓					✓
27	Multi-Purpose Meter (MPM)		✓	✓					✓
28	Real-Time Load-Based Charging		✓	✓	✓	✓	✓		✓
29	Advanced Customer Bill Scenario Calculator			✓			✓		✓
30	Connected Device Real-Time Pricing-Based Control		✓	✓			✓	✓	✓
31	Real-Time DER Price Signals		✓	✓		✓	✓		✓
32	System Harmonics for Power Quality Investigations	✓	✓		✓				

PG&E's 2018-2020 EPIC Project Portfolio

Investment Area: Cross-Cutting/Foundational Strategies

Project Information		Primary EPIC Guiding Principles			Complimentary EPIC Guiding Principles				
#	Name	Safety	Reliability	Affordability	Societal Benefits	GHG Emissions Mitigation/ Adaptation	Loading Order	Economic Dev.	Efficient Use of Ratepayer Monies
33	Cyber-Physical Integrated Security	✓	✓	✓	✓				✓
34	Local Wireless Security For Critical Facilities	✓	✓		✓				
35	Advance Security of Internet of Things (IoT) Communications	✓	✓		✓				✓
36	Cybersecurity for Industrial Control Systems	✓		✓					✓
37	Augmented Reality	✓	✓	✓					✓
38	Voltage Checks		✓	✓					✓
39	Optimized Dispatch For Restoration Events	✓		✓					✓
40	Advanced Field Reference Tool	✓	✓	✓		✓	✓		✓
41	Drone Enablement and Operational Use	✓	✓	✓	✓				✓

EPIC 3 Proposed Budget

Triennial Escalated Program Budget ($1000s)	**CEC**	**PG&E**
Utility Collection/Funding Allocation	n/a	50.1%
Authorized EPIC Funding Collection	n/a	$260,675
Program Administrator Budget by Funding Element		
Applied RD&D	$161,433	$0
TD&D	$154,395	$46,661
Market Facilitation	$56,714	$0
Program Administration	$41,625	$5,214
CPUC Program Oversight	$2,081	$261
Total	**$416,248**	***$52,135**

- Proposed budget leveraged CPUC guidance to calculated the approved CPI index in D.15-04-020, resulting incl. 2.065% annual escalation rate is based on data available at the time of this filing, for third quarters of 2014, 2015 and 2016. 2017 CPI data for the third quarter of 2017 rate was not available at the time of writing this application; therefore, this rate may be updated by the CPUC to reflect the third quarter 2017 rate.
- Proposed budget does not deduct accumulated interest, given PG&E follows this process through Annual Electric True Up process

***Note: Proposed budget in above table, does not account for PG&E request for $7M increased budget, which would be sourced by leveraging unspent EPIC 1 funds.**

Historical EPIC Project Portfolio

PG&E's Historical EPIC Project Portfolio: EPIC 1 Portfolio			
Project Name		**Project Name**	
1.01	Demonstrate energy storage end uses	1.14	Demonstrate "next generation" SmartMeter™ telecommunications network functionalities
1.02	Demonstrate the use of distributed energy storage for T&D cost reduction	1.15	Demonstrate new technologies and strategies that support integrated "customer-to- market-to-grid" operations of the future
1.03	Demonstrate priority energy storage scenarios from the Energy Storage Framework	1.16	Demonstrate electric vehicles as a resource to improve grid power quality and reduce customer outages
1.04	Expand lab test and pilot facilities for new energy storage systems	1.17	Leverage EPIC funds by participating in multi-utility, industry-wide RD&D programs such as those conducted by EPRI
1.05	Demonstrate new resource forecast methods to better predict variable resource output	1.18	Demonstrate SmartMeter™-enabled data analytics to provide customers with appliance- level energy use information
1.06	Demonstrate communication systems allowing the CAISO to utilize available renewable generation flexibly	1.19	Pilot enhanced data techniques and capabilities via the SmartMeter™ platform
1.07	Demonstrate systems to ramp existing gas-fired generation more quickly to adapt to changes in variable energy resources output	1.20	Demonstrate the benefits of providing the competitive, open market with automated access to customer-authorized SmartMeter™ data
1.08	Improve distribution system safety and reliability through new data analytics techniques	1.21	Pilot methods for automatic identification of distributed energy resources (such as solar PV) as they interconnect to the grid to improve safety & reliability
1.09	Test new remote monitoring and control systems for T&D Assets	1.22	Demonstrate subtractive billing with submetering for EVs to increase customer billing flexibility
1.10	Demonstrate new strategies and technologies to improve the efficacy of existing maintenance and replacement programs	1.23	Demonstrate additive billing with submetering for PVs to increase customer billing flexibility
1.11	Demonstrate self- correcting tools to improve system records and operations	1.24	Demonstrate DSM for T&D cost reduction
1.12	Demonstrate new technologies that improve wildlife safety and protect assets from weather- related degradation	1.25	Develop a tool to map the preferred locations for DC fast charging, based on traffic patterns and PG&E's distribution system to address EV drivers' needs while reducing the impact on PG&E's distribution grid
1.13	Demonstrate new systems to improve substation automation and interoperability	1.26	Pilot measurement and telemetry strategies and technologies that enable the cost-effective integration of mass-market DR resources into the CAISO wholesale market

Historical EPIC Project Portfolio

PG&E's Historical EPIC Project Portfolio: EPIC 2 Portfolio

Project Information		Project Information	
2.01	Evaluate storage on the distribution grid	2.16	Enhanced Synchrophasor analytics & applications
2.02	Pilot Distributed Energy Management Systems (DERMS)	2.17	Geomagnetic Disturbance (GMD) evaluation
2.03A	Test Smart Inverter enhanced capabilities	2.18	Optical sensors for protection and control systems
2.03B	Vehicle to Home	2.19	Enable distributed demand-side strategies & technologies
2.4	DG monitoring & voltage tracking	2.20	Real-time energy usage feedback to customers
2.5	Inertia response emulation for DG impact improvement	2.21	Home Area Network (HAN) for commercial customers
2.6	Intelligent Universal Transformer (IUT)	2.22	Demand reduction through targeted data analytics
2.7	Real time loading data for distribution operations and planning	2.23	Integrate demand side approaches into utility planning
2.8	"Smart" monitoring and analysis Tools	2.24	Appliance level bill disaggregation for non-residential customers
2.9	Distributed Series Impedance (DSI)	2.25	Enhanced Smart Grid Communications
2.10	Emergency preparedness modeling	2.26	Customer & distribution automation open architecture devices
2.11	New mobile technology & visualization applications	2.27	Next generation integrated Smart Grid communications network management
2.12	Emergency management mobile applications	2.28	Smart Grid communications path monitoring
2.13	Digital substation/substation automation	2.29	Mobile meter applications
2.14	Automatically map phasing information	2.30	Leverage EPIC funds to participate in industry-wide RD&D programs
2.15	Synchrophasor applications for generator dynamic model validation		

PG&E's EPIC 3 Application Overview

1. EPIC Investment Framework

- Captures overarching EPIC guiding principles of safety, reliability and cost-effective / affordable energy policy attainment and demonstrates linkage between Investment Plans and key policy goals. The framework outlines the primary investment areas, similar to previous EPIC Investment Plans
- PG&E collaborated with Administrators, EPRI and industry stakeholders to gain input on the proposed portfolio

2. RD&D Vision & Strategy

- Address emergent grid needs while continuing to provide safe and reliable services for our customers and advance California energy policies in a cost-effective manner. This aligns with PG&E's Grid of the Future strategy.
- Four lens approach for selecting and executing projects: (1) Policy/Regulatory Alignment; (2) Alignment to Strategies and Customer Needs; (3) Alignment with Innovation Characteristics; and (4) Alignment to Project Governance Considerations

3. 2018-2020 Project Portfolio

- The proposed projects are organized into the four investment areas:

  (1) Renewable & DER Integration; (2) Grid Modernization / Optimization; (3) Customer Service / Enablement; and (4) Cross Cutting / Foundational. Projects also account for the learnings from the previous Investment Plan cycles (e.g. Advanced DERMS functionality)

4. Administration and Governance

- Proposed 2018-2020 Budget, including assumptions made
- PG&E proposed modifications to previous CPUC Decisions
- Request for approval of projects in Advice Letter 5015-E (if not yet approved or determined "not imminently needed" before the approval of this EPIC 3 proposed portfolio)

5. Metrics, Measurement & Evaluation

- To measure the success of a project and identify expected benefits at full scale, projects leverage CPUC adopted metrics (D. 13-11-025) and are included in project final report that is shared publically

Appendices

- Summary of EE/DR Pilots
- Summary of Stakeholder Feedback from Public Workshops

EPIC Project Supplier Participation Information

EPIC Project Supplier Participation Process

PG&E has established process to inform interested parties of PG&E's EPIC Portfolio Contract Opportunities, including EPIC:

Pre-Qualify

- Follow COAs on PG&E website: www.pge.com/bidopportunities
- Community-Based Orgs receive notifications of posted COAs and they distribute to their members

Participate in RFP

- After pre-qualifying via COA, suppliers will be invited to RFP

Winning Supplier Selected

- PG&E will follow standard procurement process to score and select winning bidder

Diverse Supplier Participation

PG&E Diverse Supplier information, including qualification criteria, can be found online at the below link or email SupplierDiversityTeam@pge.com: www.pge.com/diversitysupplier

**Where a unique or specific expertise or capability is identified for an individual project, PG&E may employ sole source procurement procedures following CPUC established evaluation guidance (D.13-11-025) and PG&E's established procurement processes.*

IOU Contact Information

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Pacific Gas and Electric Company

SDGE A Sempra Energy utility

SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company